Bendix®

Service Data

SD-03-1063

Bendix® R-12P™ Pilot Relay Valve

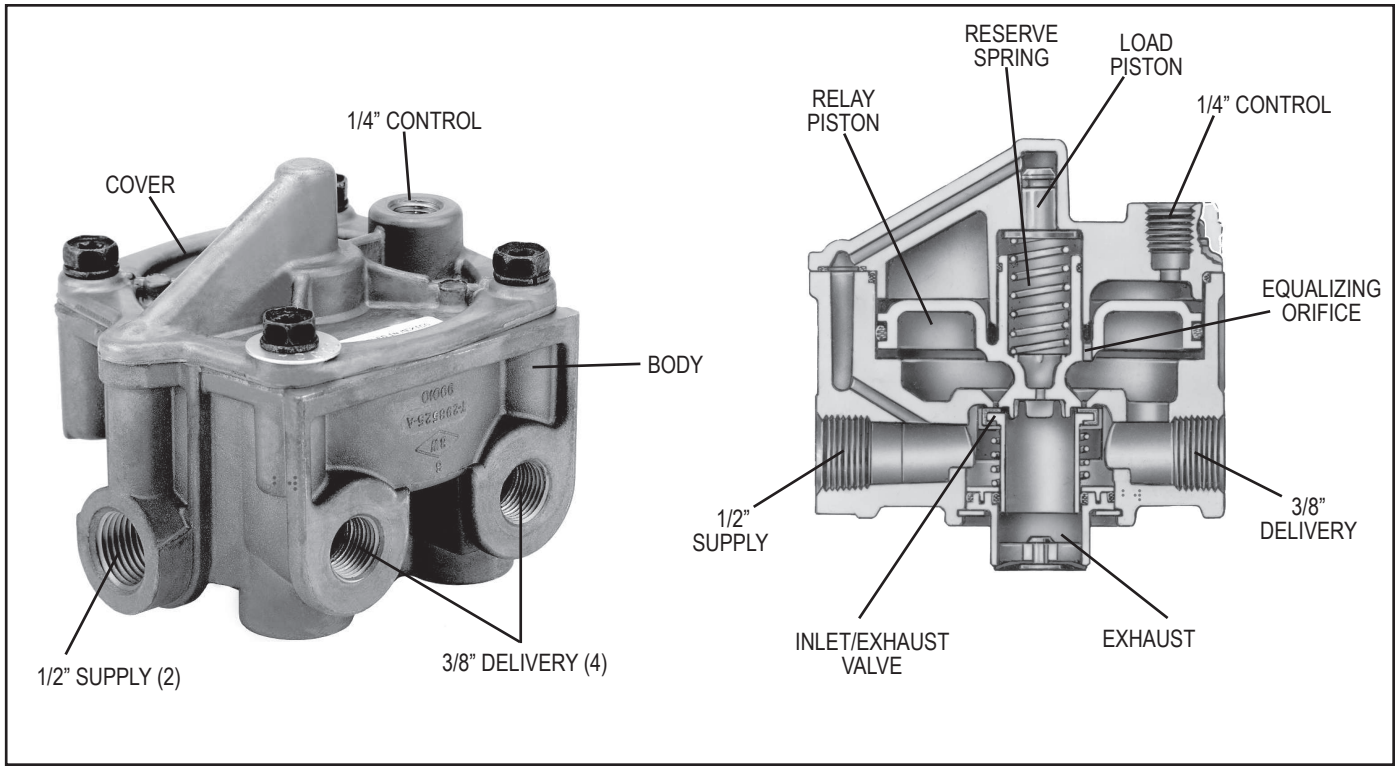

FIGURE 1 - CUTAWAY AND EXTERNAL VIEW

DESCRIPTION

The Bendix® R-12P™ pilot relay valve is designed to speed up control signal application and release on long non-towing trailers, towing trailers, dollies, and long wheelbase tractors. It does this without adversely affecting the control signal. The R-12P™ valve replaces the current R-8P™ valve.

Unlike a standard relay valve used as a "booster," which typically has a 2-4 psi differential between control and delivery, the R-12P™ valve has zero differential. It "speeds" up control line signal application and release in a train of vehicles, and it delivers the same air pressure that it receives. This provides a uniform brake signal to all trailer and dolly brakes, even during light applications.

The unique R-12P™ valve feature is that it uses a supply air pressure load to quicken the valve's response time. By balancing the pressure signal to all trailer and dolly brakes, the R-12P™ valve aids in achieving overall vehicle brake pressure balance, timing balance, and stability.

It also substantially improves brake lining wear balance on combination vehicles by making even the most distant brake contribute its share of braking effort.

Figure 2 shows the R-12P™ valve in a trailer air brake schematic. Note that additional air lines for a towing trailer are shown as dashed lines.

The R-12P™ valve uses the Bendix® R-1® valve family lower body and standard Bendix mounting brackets. It can also be reservoir-mounted.

The body and cover are die-cast aluminum, and the valve's weight is approximately 2.3 lbs. Porting is as follows:

	Qty.	Size
Supply (SUP)	2	1/2"
Delivery (DEL)	4	3/8"
Control (CON)	1	1/4"
Exhaust (EXH)	1	--

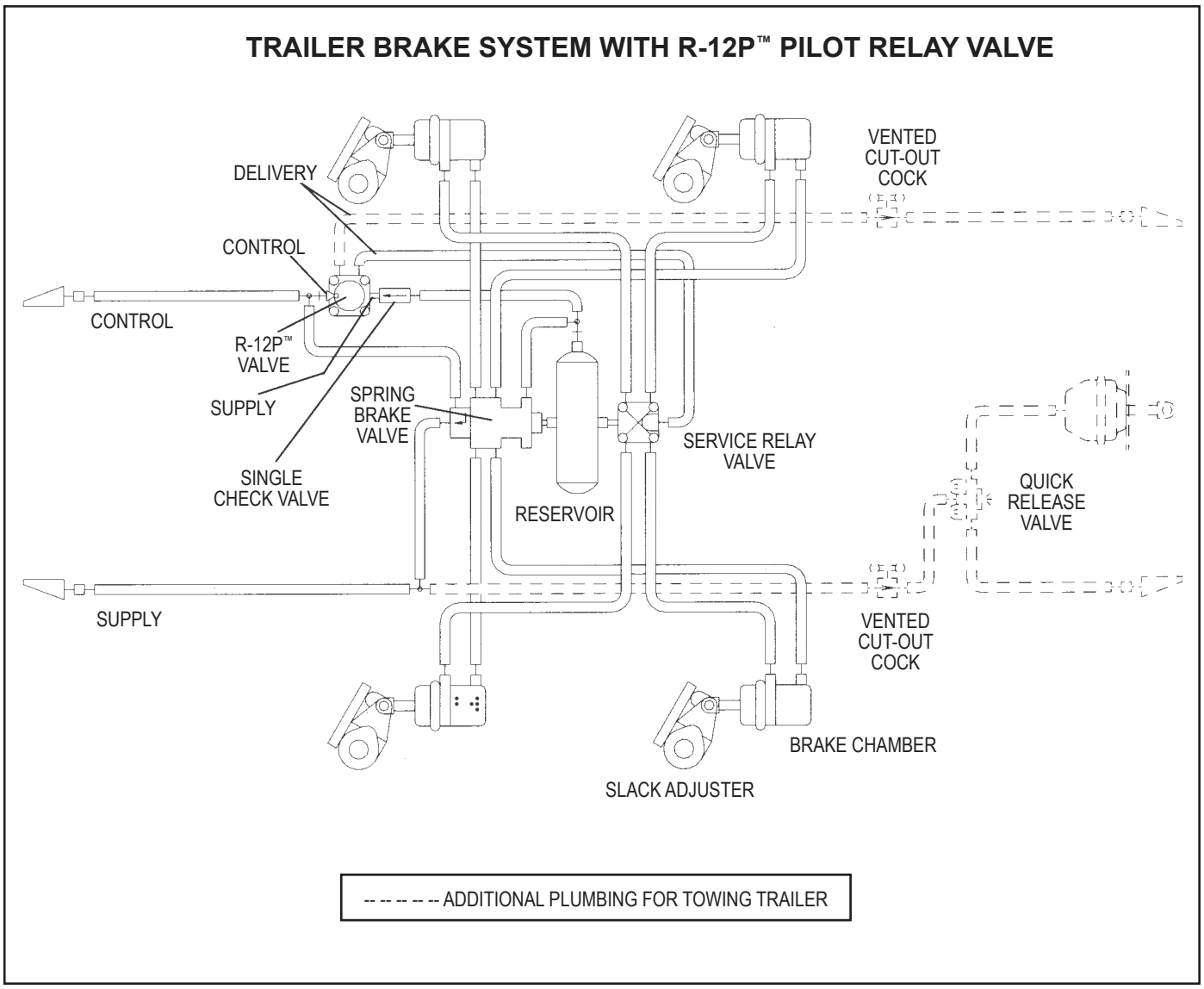

FIGURE 2 - TYPICAL R-12P™ PILOT RELAY VALVE SYSTEM SCHEMATIC

OPERATION

CHARGING

When the air brake system is charging, the relay piston's exhaust seat is against the inlet/exhaust valve due to the force of the reserve spring. Reservoir air enters the Bendix® R-12P™ valve supply port and becomes active upon the inlet/exhaust valve. At the same time, reservoir air passes through the R-12P™ valve body channel to the load piston. Supply air builds simultaneously and equally underneath the inlet/exhaust valve and above the load piston. While supply pressure continues to hold the inlet/exhaust valve against its seat, it also moves the load piston into contact with the relay piston. However, even though force is increasing on the relay piston, it does not move the inlet/exhaust valve. The effective area of the inlet/exhaust valve is larger than the effective area of the load piston. Therefore, load piston force cannot overcome inlet/exhaust valve force. So supply air builds to governor cut-out and the inlet/exhaust valve remains closed. This is the position of the R-12P™ valve in normal run mode, as shown in Figure 3.

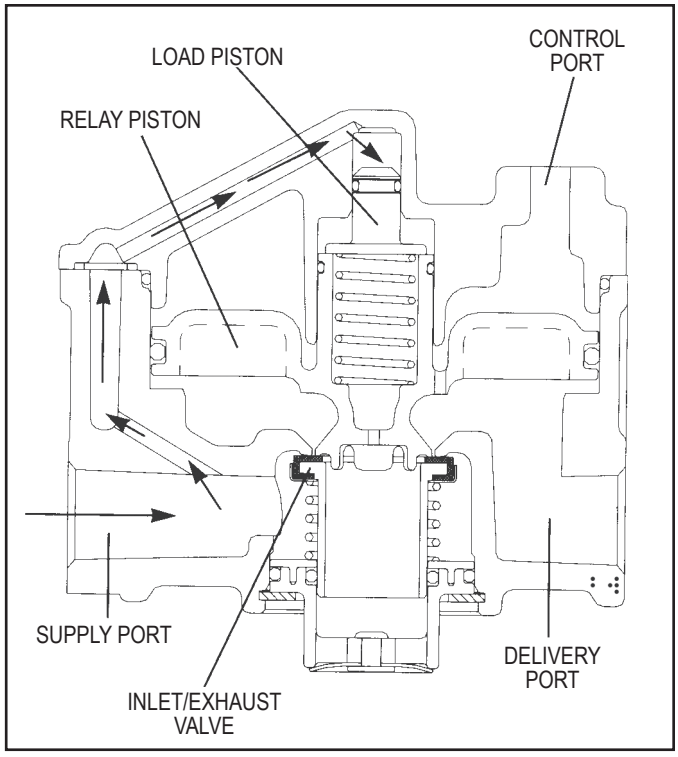

FIGURE 3 - CHARGING

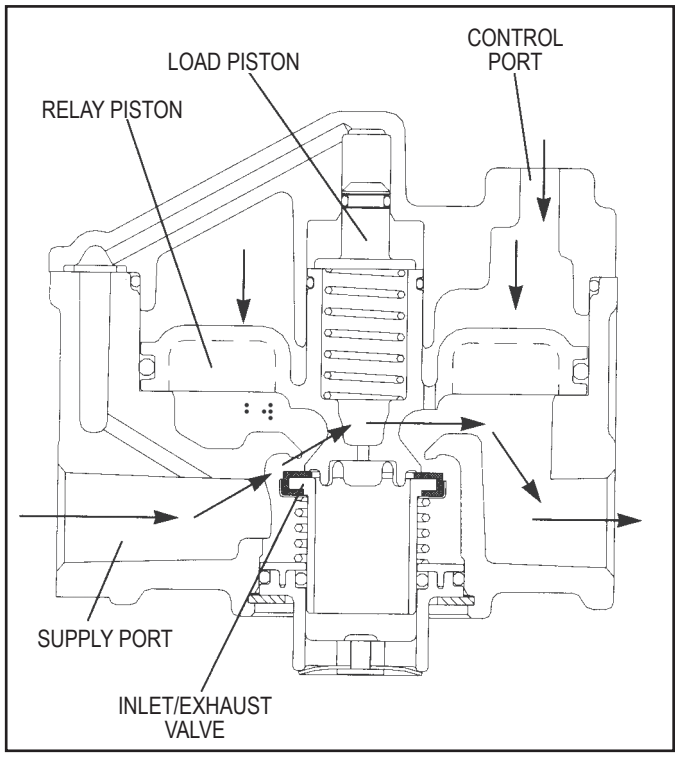

FIGURE 4 - NORMAL (RAPID) APPLICATION

NORMAL (RAPID) APPLICATION

Figure 4 shows a Bendix® R-12P™ valve receiving a "normal" service brake application. "Normal" means the control signal is applied rapidly enough to build up pressure on the relay piston and "open" the inlet valve, causing the R-12P™ valve to react like a relay valve. The relay piston opens the inlet, allowing supply air to flow out the delivery port to the next valve in the system.

Note that these events occur quickly, due to the "preload" on the relay piston. This preload, provided by supply air pressure acting on the load piston, is a feature unique to the R-12P™ valve.

BALANCE

Air pressure being delivered by the open inlet valve is also effective underneath the R-12P™ valve relay piston. When air pressure beneath the piston approaches control pressure on top of the piston, the piston and inlet valve lift together and close the inlet valve. The exhaust remains closed, and the valve achieves "force balance." That is, the piston and inlet/exhaust valve are in their neutral state. This is the position commonly known as "balanced" when referring to conventional relay valves. However, conventional relay valves cannot achieve true air pressure balance because of their inherent differentials. The R-12P™ valve achieves this balance because of its equalizing orifice. The orifice allows control pressure and delivery pressure to be "common" and equalize. In this position, shown in Figure 5, sustained service brake applications can be held, with no "residual" differential.

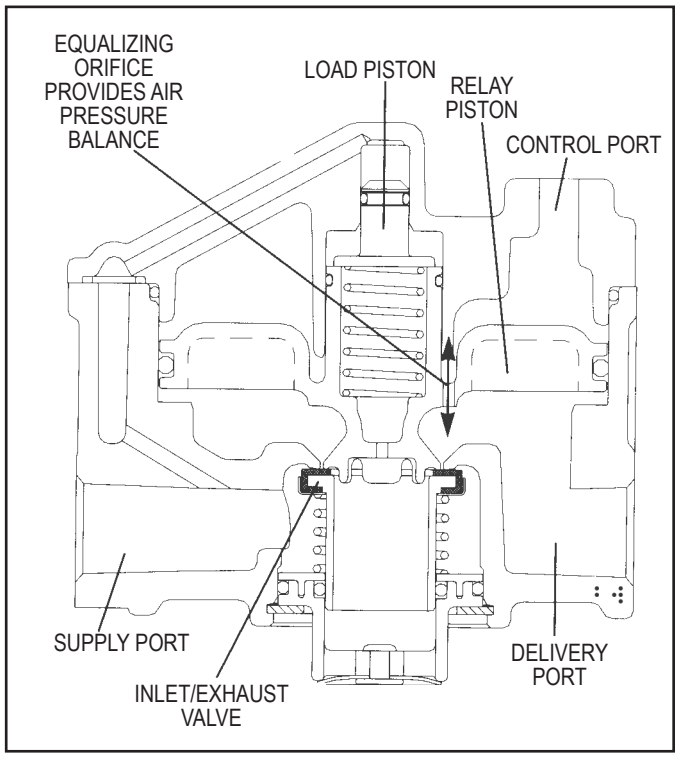

FIGURE 5 - BALANCE

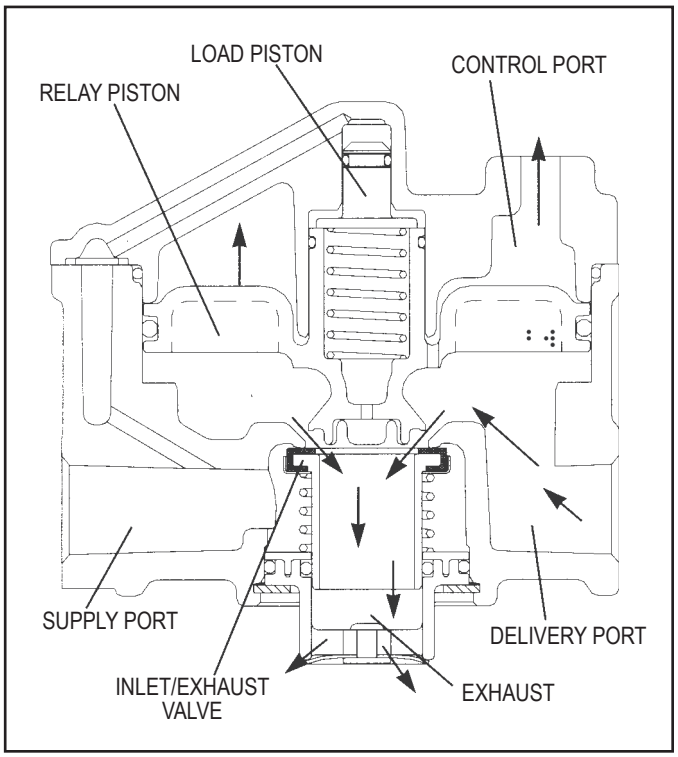

FIGURE 6 - RAPID EXHAUST

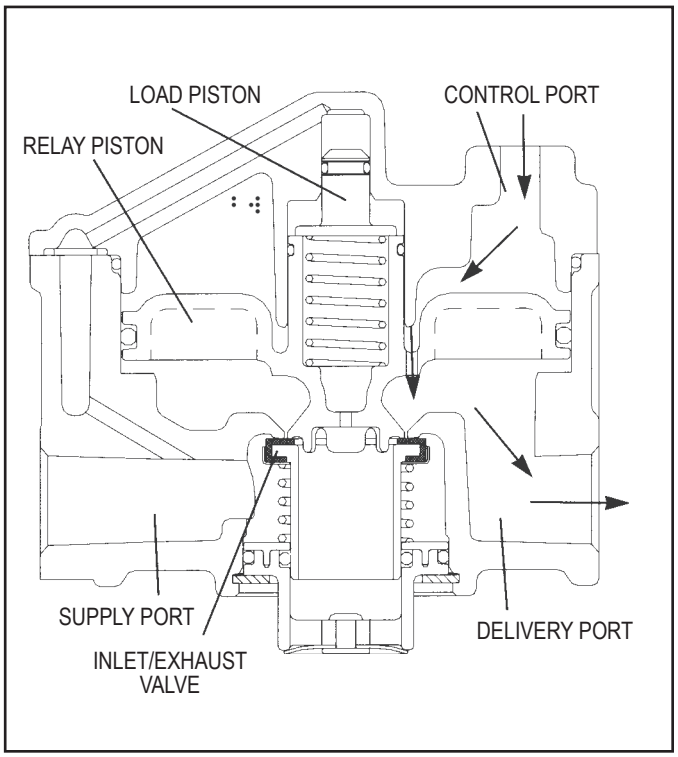

FIGURE 7 - EQUALIZING (SLOW) APPLICATION

RAPID EXHAUST

Figure 6 shows a rapid service brake release. Air above the relay piston travels back out the control port to be exhausted. With the lack of air pressure above the piston, air pressure below lifts the piston, closing the inlet and opening the exhaust. Delivery air then exhausts to atmosphere.

EQUALIZING (SLOW) APPLICATION

When a control signal enters the Bendix® R-12P™ valve, it acts on the relay piston. However, Figure 7 shows the control signal passing through the valve without causing piston movement. The air is passing through the relay piston's equalizing orifice, directly through the valve and out the delivery port to the next valve in the air system. This situation occurs if air pressure build-up is slow and the pressure above the relay piston is not strong enough to open the valve. (Air pressure above the piston must be at least 3 psi greater than air pressure below the piston to cause movement.)

In the equalizing application, even though the inlet valve does not open, the control signal is not decreased because the equalizing orifice allows it to pass directly through the R-12P™ valve. Note that this condition exists during very slow service brake applications.

For example, if a vehicle is traveling over a long downhill grade, the driver may want to limit speed and maintain vehicle control through proper gearing, engine speed and a light service brake application.

If, during the light brake application, the driver modulates the treadle slowly, and not enough to open the R-12P™ inlet valve, the desired control pressure will still pass on to the next valve, maintaining zero differential.

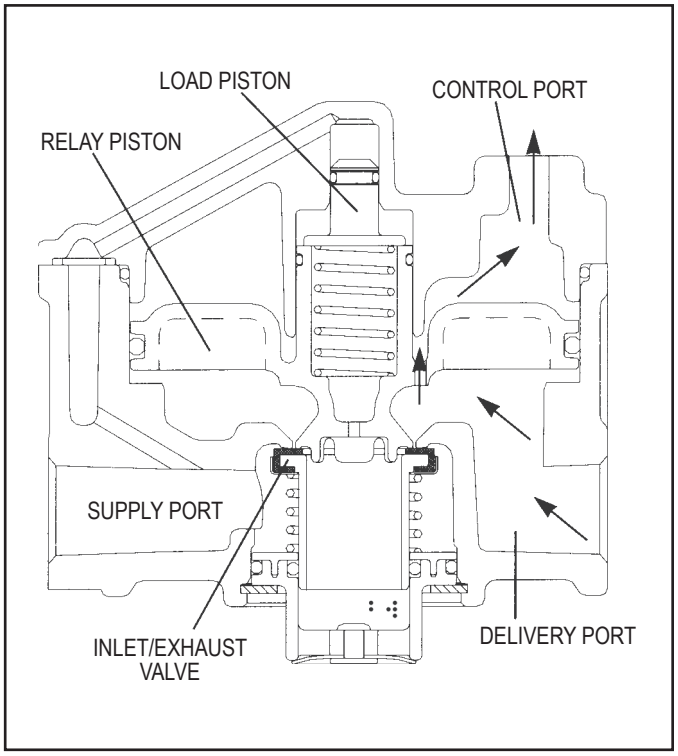

FIGURE 8 - EQUALIZING (SLOW) EXHAUST

EQUALIZING (SLOW) EXHAUST (SEE FIGURE 8)

As described earlier, the result of any service brake application with a Bendix® R-12P™ valve is air pressure balance above and below the relay piston. If the brake valve is modulated slowly upon release so that pressure beneath the piston is not great enough to open the exhaust, delivery air will pass through the equalizing orifice and out the control port to be exhausted.

REDUCTION OF SUPPLY PRESSURE

Figure 9 shows the R-12P™ valve with no supply pressure. With no supply air, the reserve spring is strong enough to hold the relay piston on the exhaust seat, but it is not strong enough to overcome the force of the inlet/exhaust valve spring. So both inlet and exhaust valves are closed.

Service Brake Applications with Reduced Supply Pressure

Rapid Application - Use of Supply Line Single Check Valve

If a rapid service brake application is made, control air moves the relay piston and opens the inlet valve; but there is no supply air to deliver. Control air then travels into the supply port. The single check valve in the R-12P™ valve supply port (shown in Figure 2) prevents this air from escaping to atmosphere through the open or damaged supply source. Control air also passes through the equalizing orifice and out the delivery port, assuring no reduction or loss of control signal to subsequent vehicles.

Equalizing (Slow) Application

If an equalizing (slow) service brake application is made with reduced supply air pressure, control air passes through the equalizing orifice and out the delivery port to subsequent vehicles in the train.

Control air cannot escape to atmosphere because the reserve spring keeps the exhaust closed.

PREVENTIVE MAINTENANCE

Important: Review the Bendix Warranty Policy before performing any intrusive maintenance procedures. A warranty may be voided if intrusive maintenance is performed during the warranty period.

No two vehicles operate under identical conditions, as a result, maintenance intervals may vary. Experience is a valuable guide in determining the best maintenance interval for air brake system components. At a minimum, the valve should be inspected every 6 months or 1500 operating hours, whichever comes first, for proper operation. Should the valve not meet the elements of the operational tests noted in this document, further investigation and service of the valve may be required.

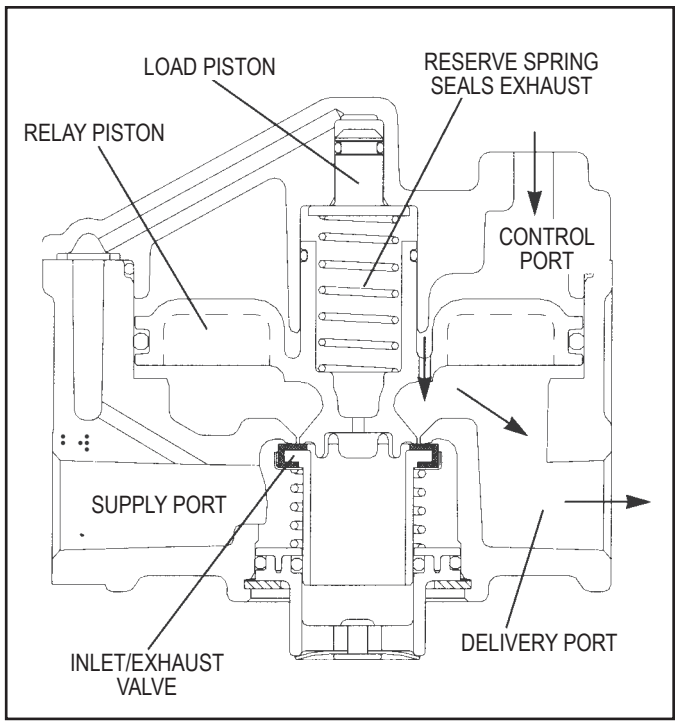

FIGURE 9 - REDUCTION OF SUPPLY PRESSURE

SERVICE CHECKS

1. Remove any accumulated contaminants. Visually inspect the valve's exterior for excessive corrosion or physical damage. Repair/replace the valve as necessary.
2. Inspect all air lines connected to the valve for signs of wear or physical damage. Repair/replace as necessary.
3. Test air line fittings for excessive leakage and tighten or replace as necessary.

OPERATIONAL AND LEAKAGE TESTS

1. Block the vehicle's wheels and fully charge the air system.
2. Apply and release the service brakes several times and check for prompt response of the brakes at all appropriate wheels.
3. With the air system fully charged, apply a soap solution to the R-12P™ valve exhaust port. Leakage of a 1" bubble in 5 seconds is permissible.
4. Make and hold a full brake application and again apply a soap solution to the R-12P™ valve exhaust. Leakage of a 1" bubble in 3 seconds is permissible.
5. With the brakes still applied, apply a soap solution around the valve where the cover meets the body. No leakage at this point is permitted.

If the valve does not function as described; or if leakage is excessive, repair the valve or replace it at any authorized parts outlet.

GENERAL SAFETY GUIDELINES

WARNING! PLEASE READ AND FOLLOW THESE INSTRUCTIONS TO AVOID PERSONAL INJURY OR DEATH:

When working on or around a vehicle, the following general precautions should be observed at all times.

1. **Park the vehicle on a level surface, apply the parking brakes, and always block the wheels. Always wear safety glasses.**
2. **Stop the engine and remove ignition key when working under or around the vehicle. When working in the engine compartment, the engine should be shut off and the ignition key should be removed. Where circumstances require that the engine be in operation, EXTREME CAUTION should be used to prevent personal injury resulting from contact with moving, rotating, leaking, heated or electrically charged components.**
3. **Do not attempt to install, remove, disassemble or assemble a component until you have read and thoroughly understand the recommended procedures. Use only the proper tools and observe all precautions pertaining to use of those tools.**
4. **If the work is being performed on the vehicle's air brake system, or any auxiliary pressurized air systems, make certain to drain the air pressure from all reservoirs before beginning ANY work on the vehicle. If the vehicle is equipped with a Bendix® AD-IS® air dryer system or a dryer reservoir module, be sure to drain the purge reservoir.**
5. **Following the vehicle manufacturer's recommended procedures, deactivate the electrical system in a manner that safely removes all electrical power from the vehicle.**
6. **Never exceed manufacturer's recommended pressures.**
7. **Never connect or disconnect a hose or line containing pressure; it may whip. Never remove a component or plug unless you are certain all system pressure has been depleted.**
8. **Use only genuine Bendix® brand replacement parts, components and kits. Replacement hardware, tubing, hose, fittings, etc. must be of equivalent size, type and strength as original equipment and be designed specifically for such applications and systems.**
9. **Components with stripped threads or damaged parts should be replaced rather than repaired. Do not attempt repairs requiring machining or welding unless specifically stated and approved by the vehicle and component manufacturer.**
10. **Prior to returning the vehicle to service, make certain all components and systems are restored to their proper operating condition.**
11. **For vehicles with Automatic Traction Control (ATC), the ATC function must be disabled (ATC indicator lamp should be ON) prior to performing any vehicle maintenance where one or more wheels on a drive axle are lifted off the ground and moving.**

NOTE: If a supply line single check valve is present *(see Figure 2),* check it for leakage. Disconnect the inlet side of the single check valve and coat the open end with a soap solution. Make and hold a full brake application. Leakage of a one inch bubble in five seconds is permissible. If the valve's leakage is excessive, replace it with a *1/2"* single check valve.

REMOVAL

1. Drain all system air pressure.
2. Identify and mark or label all air lines and their connections to the Bendix® R-12P™ valve and the single check valve, if present. Then disconnect the air lines.
3. Remove the R-12P™ valve from the vehicle.

INSTALLATION

1. Use the mounting bracket provided, or, if securing the valve to a reservoir, use a Schedule 80 (heavy wall) short couple pipe nipple.
2. Reconnect all air lines to the valve using the identification made during removal. Be sure to use pipe thread sealant.
3. Test all air fittings for excessive leakage and tighten as needed. Also, perform OPERATIONAL AND LEAKAGE TESTS before placing the vehicle back into service.

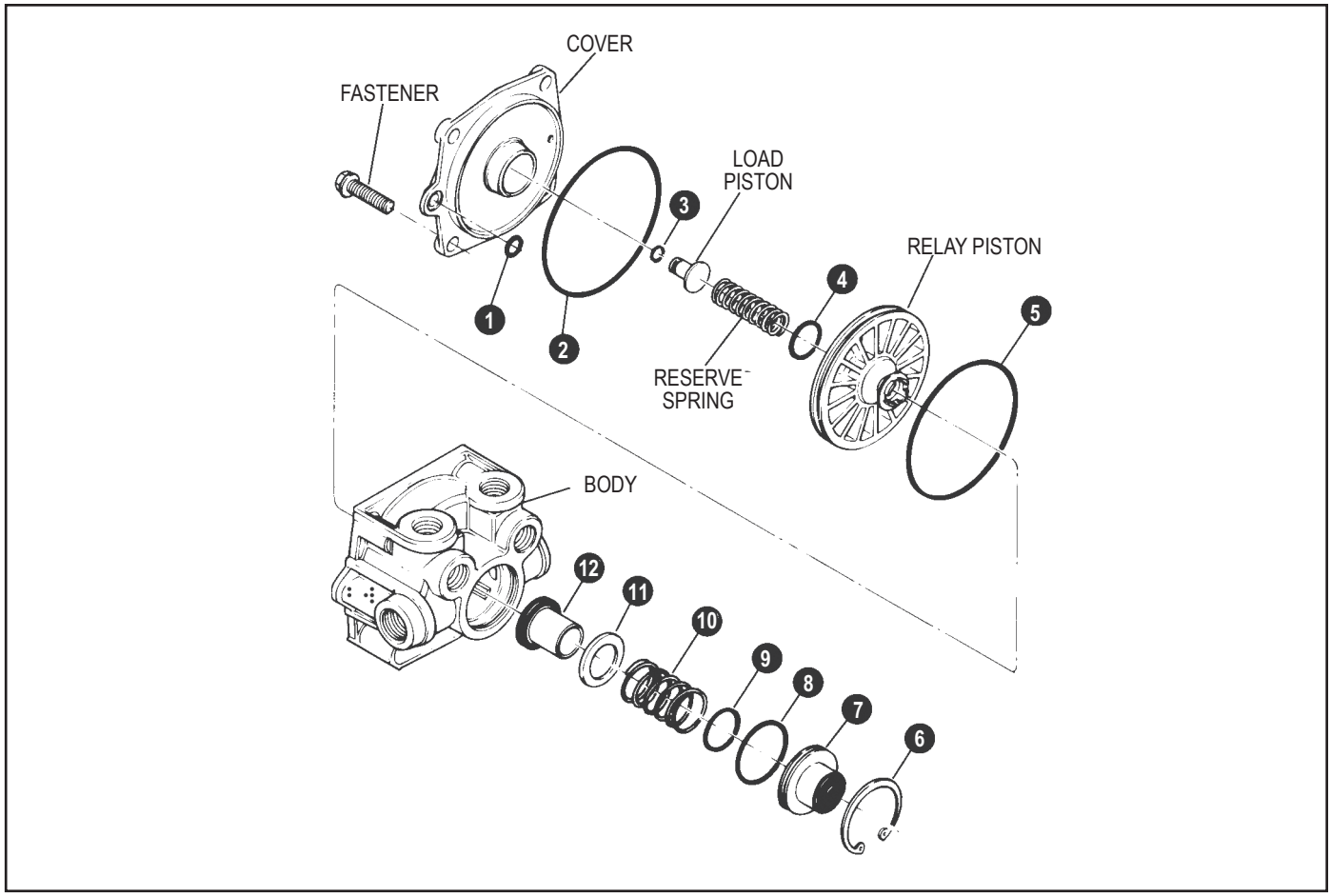

FIGURE 10 - EXPLODED VIEW

DISASSEMBLY

The following procedure is for reference only. Always have the appropriate maintenance kit on hand, and use its instructions in lieu of those presented here. Refer to Figure 10 throughout.

CAUTION: The Bendix® R-12P™ valve may be lightly clamped in a bench vise during disassembly. However, overclamping will cause damage to the valve and result in leakage and/or malfunction. If a vise is used, position the valve so the jaws bear on the supply ports on opposing sides of the valve's body.

1. Remove the four fasteners that secure the cover to the body. Then slowly remove the cover.
2. Remove and discard the small o-ring (1) that seals the internal channel and the large o-ring (2) between the cover and the body.
3. Remove the load piston from the cover. Note: If necessary, use approximately 20 psi of shop air, directed into the load piston's air passage in the cover, to dislodge it. CAUTION: The piston will leave the cover with some force.
4. Remove and discard the load piston's o-ring (3).
5. Remove the reserve spring and the relay piston from the body. Remove and discard the relay piston's o-rings (4) and (5).
6. While holding exhaust cover (7), remove and discard the snap ring (6) that secures the cover to the body.
7. Remove and discard exhaust cover (7) and its o-rings (8) and (9).
8. Remove and discard valve spring (10), valve retainer (11), and inlet/exhaust valve (12) from the body.

CLEANING & INSPECTION

1. Using mineral spirits or an equivalent solvent, clean and thoroughly dry all metal parts. Do not damage bores with metal tools.
2. Wash all non-metallic components in a soap and water solution. Dry thoroughly.
3. Inspect interior and exterior of all metal parts for severe corrosion, pitting, and cracks. Superficial corrosion and/or pitting on the exterior of the body and cover is acceptable. Replace the entire valve if the body or cover interior show signs of corrosion or pitting.
4. After washing, inspect relay piston for cracks, wear, or distortion. Replace the valve if these conditions are found.

5. Make certain the air channel running from the cover through the top surface of the body to the supply port is clear and free of obstruction.
6. Inspect the pipe threads in the body. Make certain they are clean and free of thread sealant.
7. Inspect all air line fittings for corrosion. Replace as necessary. Remove all old thread sealant before reuse.

ASSEMBLY

1. Before assembly, lubricate all o-rings, seals, and pistons as well as body and cover bores, using the lubricant provided in the maintenance kit. Use all of the lubricant, and spread it evenly on all rubbing surfaces.
2. Install valve retainer (11) on inlet/exhaust valve (12) so that the flange of the retainer surrounds the rubber portion of the valve.
3. Install inlet/exhaust valve (12) in the body.
4. Install valve spring (10) over the inlet/exhaust valve in the body.
5. Install large and small diameter o-rings (8) and (9) in exhaust cover (7).
6. Place the exhaust cover on the inlet/exhaust valve spring. Then depress the cover against the spring's force into the body. Secure the cover with the snap ring (6).
7. Install o-rings (4) and (5) onto the relay piston. Then place the reserve spring in the piston and install the piston into the body.
8. Install the load piston's o-ring (3) onto the load piston. Then install the load piston into the cover, small end first.
9. Install small o-ring (1) that seals the internal channel and large o-ring (2) onto the cover.
10. Place the cover on the body and secure with its four fasteners. Torque to 120 - 150 in. lbs.
11. Perform OPERATIONAL AND LEAKAGE TESTS before returning the vehicle to service.

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